ACCESSION #: 9606280170

LICENSEE EVENT REPORT (LER)

FACILITY NAME: BYRON NUCLEAR POWER STATION PAGE: 1 OF 6

DOCKET NUMBER: 05000454

TITLE: Loss of Offsite Due to a Failure of an Insulator on Phase

B of the Unit 1 Station Auxiliary Transformer From Water

Intrusion

EVENT DATE: 05/23/96 LER #: 96-007-00 REPORT DATE: 06/21/96

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 5 POWER LEVEL: 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Ray Choinard, Root Cause Expert TELEPHONE: (815) 234-5441

X2041

COMPONENT FAILURE DESCRIPTION:

CAUSE: XP E4 SYSTEM: EB COMPONENT: Electrical Insulator

XI E2 IG SR/IR Detector

MANUFACTURER: H.K. Porter

Westinghouse

REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On 5/23/96, Unit 1 experienced a Loss of Offsite Power (LOOP) for more that fifteen minutes. As a result of the LOOP, the Station Air Compressors and non-essential service water pumps were lost. This lead to a decision to manually trip Unit 2.

The LOOP resulted from a fault on Station Auxiliary Transformer (SAT) 142-2. The fault was caused by a failed insulator on the B phase on the non-segregated bus duct. The insulator failed due to water intrusion into the bus duct. Water leaked into the bus duct because of caulk that was leaking and a poor seal between the retaining bolts for the insulator and the bus duct.

The bus duct was repaired, the other bus ducts were inspected, and changes to the preventative maintenance of the non-segregated bus ducts are planned.

After Unit 2 was manually tripped, Source Range Detector, N31, failed to energize. The cause was a failed detector. The detector was replaced.

There was a previous event of water intrusion into the non-segregated bus ducts at Byron Station prior to 1984 (before fuel load).

These events are reportable in accordance with 10CFR50.73(a)(2)(iv) as any event or condition that resulted in a manual or automatic actuation of any engineered safety feature (ESF), including the reactor protection system (RPS).

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A. PLANT CONDITIONS PRIOR TO EVENT:

Event Date/Time 05-23-96 / 0804

Unit 1 Mode 5 - Hot Shutdown Rx Power 0% RCS [AB]

Temperature/Pressure 85/350

Unit 2 Mode 1 - Power Operations Rx Power 100% RCS [AB)

Temperature/Pressure NOT/NOP

B. DESCRIPTION OF EVENT:

Prior to this event, the Unit 2 Station Air Compressor (SAC)[LF] and

the OC Non-essential Service Water (WS)[KG] were Out-of-Service. By

not having these available, a manual trip of Unit 2 was required. This increased the severity of this event.

Unit 1 Event

On 5/23/96 at 08:04, Unit 1 Station Auxiliary Transformers (SAT's) [EB] isolated due to a phase A to phase B current differential relay operation. This de-energized all 4.16 kV and 6.9 kV buses on Unit 1.

At 08:22, an Usual Event was declared due to the loss of offsite power for greater than 15 minutes.

At 08:29, shift personnel notified the State of Illinois about the event.

At 08:36, shift personnel made notification to the NRC via the ENS about the event.

Both the 1A and 1B Diesel Generators (DG) [EK] auto started and loaded on to ESF busses 141 and 142. The non-ESF busses, 143 and 144, both remained de-energized. Since the OA and OB Non-essential Water (WS) [KG] pumps and Unit 1 and Unit 0 Station Air Compressors (SACs) [LD] were powered from 143/144, they tripped when power was lost.

Unit 2 Event

Without the WS pumps (Non-essential cooling water is a unit common system), Unit 2 did not have cooling water to many loads including Generator Auxiliaries, SAC's, and Condensate/Condensate Booster

pumps. Because there was no cooling to secondary systems or station air, the Unit 2 reactor was manually tripped at approximately 08:06.

Unit 2 responded normally from a manual Reactor trip except for the following:

o Source Range Detector [IG], N-31 failed to energize.

o The 2A Steam Generator Power Operated Relief Valve (PORV) [SB] failed to close in manual mode, and

o Process radiation monitor [IL], 2PR09J, "Component Cooling Water Heat Exchanger 2 Outlet Monitor Skid," experienced a loss of communication with the main console (RM-11) in the control room.

Unit 2 remained stable in Mode 3 until the decision was made to cool down to Mode 5 for repair of 2RC8075D, "2D RC Loop Cold Leg RTD Manifold Outlet Isolation Valve." This valve was found leaking during the post trip containment walk down.

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B. DESCRIPTION OF EVENT (cont.)

All rods inserted into the core. (This statement satisfies ComEd's commitment to NRC Bulletin 96-01 for reporting post trip rod insertion.)

These events are reportable in accordance with 10CFR50.73(a)(2)(iv) as any event or condition that resulted in a manual or automatic

actuation of any engineered safety feature (ESF), including the reactor protection system (RPS).

C. CAUSE OF EVENT:

Unit 1 Event

Switchyard breakers OCB 5-6 and ACB 6-7 feed the Unit 1 SAT. The Unit 1 SAT consists of two transformers numbered 142-1 and 142-2. Each provides a 4.16 kV and 6.9 kV feed to Unit 1 - These feeds are further subdivided inside the Auxiliary Building (AB) into two 4.16 kV buses (one Safety Related and one Non-Safety Related) and two non-safety related 6.9 kV buses. The buses coming from each SAT into the AB are run in two, non-segregated bus ducts, one for the 4.16 kV and one for the 6.9 M The three phases of 4.16 kV are all in the same duct (non-segregated), separated from each other by about four inches. They are supported from the top of the bus duct by insulators. The 6.9 kV bus design is similar.

The Unit 1 SAT 142-2 underwent a phase to ground fault on a phase B insulator. The location of the failed insulator was about half-way between the SAT and the AB. Upon flashing, the arc continued down the bus bar, increasing in width until it involved the other two phases.

The specific evidence that supports this conclusion was the insulator damage and water found still dripping through the bus duct onto the damaged insulator several hours after a rain shower. The

initial point of arcing was at this insulator and subsequent splatter of bus material could be followed from this point towards the AB. As the arc heated the air and water in the duct, the duct pressurized. This caused the bottom duct bus panels to bulge until the pressure was relieved through small vent holes in the panels.

The primary reason for the event was chronic water leakage through the insulator mounting holes. This lead to the failure of the phase B insulator. The water caused the degradation of the insulator metal inserts and insulator material between these inserts. Eventually the bus flashed to ground through the degraded insulator and initiated the event.

The cause of the water leakage has two components:

1) There is a weld axially down the center of the top of the duct that the center insulator mounting bolts must straddle. This will not allow the channel-to-duct seal to be compressed properly.

2) The caulk put on the channel-to-duct interface to supplement sealing this barrier is very thin in the area of leakage on this insulator and was not sealed completely (see Figure 1).

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C. CAUSE OF EVENT (cont.)

These two factors allowed water to seep into the insulator center and caused the insulator inserts to corrode and eventually fail (see Figure 2).

Unit 2 Event

Source Range Detector, N31, failed to energize because of a failed detector.

D. SAFETY ANALYSIS:

Unit 1 Event

Unit 1 ESF equipment functioned as designed. The Auxiliary Power (AP)[EA] system isolated the fault immediately to prevent further damage to equipment/components. With Unit 1 in Mode 5, all Unit 1 4.16 kV and 6.9 kV buses were powered from SAT 142-1 and 142-2. Per design, only the ESF (bus 141 and 142) buses automatically re-energized from 1A and 1B DGs. With both ESF buses energized the reactor core cooling was then re-established by starting the 1A RH pump. The 1B RH train was also available.

Unit 2 Event

U-2 was manually tripped to prevent damage to secondary equipment per procedure. An automatic trip would have occurred eventually due to loss of 1A that would have caused the Feedwater regulating valves to fail closed. Unit 2 equipment/components functioned properly except for:

Source Range Detector N-31 [IG] failed to energized. This was

not significant since N-32 was available and energized.

The 2A Steam Generator PORV [SB] failed to close in manual mode using the controller. This was not significant because it was isolated by taking the control switch to close. And the other PORVs were available for core heat removal.

Process radiation monitor 2PR09J [IL] experienced a loss of communication with the RM-11. This was not significant because two other monitors were available to monitor component cooling.

All unit buses remained energized by the Unit 2 SAT's (242-1 & 242-2). During the recovery of Unit 2, there was damage to the 2C Feedwater [SJ] pump recirculation line due to a water hammer event. The cause of this event was investigated under a separate report (PIR 455-200-96-0003).

E. CORRECTIVE ACTIONS:

Unit 1 Event

On the Unit 1 non-segregated bus duct (SAT 142-2), the following were completed or are planned:

All the insulator inserts on the Unit 1, 142-2, bus duct were inspected for rust and signs of water leakage. Insulators with rust were removed and cleaned or replaced. All insulators were cleaned. The damaged insulator was replaced.

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E. CORRECTIVE.ACTIONS (cont.)

The tightness of the bolts holding the insulator footings to the channel steel was verified to be adequate.

The inside of the bus duct was cleaned.

The damaged cross braces were repaired.

All the channel steel was recaulked.

The rubber seals on the channel steel that was supporting the insulator that failed were replaced with two rubber seals placed on top of each other. The weld was ground down.

The five year preventative maintenance for the bus was done. This was last done in September of 1991.

The Unit 1, 4.16kV (SAT 142-1) and the 6.9kV (SAT 142-1 and SAT 142-2), non-segregated bus ducts were visually inspected to evaluate the condition of the caulking. Areas that had insufficient or lacked caulking were recaulked.

The Unit 2, 4.16kV and 6.9kV, non-segregated bus ducts (SAT 242-1 and SAT 242-2) were visually inspected to evaluate the condition of the caulking. Areas that had insufficient or lacking caulking were recaulked. Only accessible areas were inspected.

The lessons learned from this event will be shared with other ComEd stations. NTS item 454-240-96-0054-08 will track this action.

After final repairs are completed on the bus duct for SAT 142-2, the full list of repairs will be reviewed for implementation on the

other non-segregated bus ducts and for incorporation into the PM program. NTS item 454-240-96-0054-11 will track this action.

Unit 2 Event

The failed Source Range Detector was replaced and calibrated.

The M/A (Manual/Auto) station for the 2A Steam Generator PORV was inspected under Work Request 960051435 and no problems were found. The valve was also stroke tested with no problems. No further actions are planned.

Radiation monitor 2PR09J loss of communication cleared at about 1203 that day and no work was done on the monitor. The cause of the communication problem is unknown.

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F. RECURRING EVENTS SEARCH AND ANALYSIS:

SOER 90-1, "GROUND FAULTS ON AC ELECTRICAL DISTRIBUTION SYSTEMS."

This SOER discusses six events that occurred in the industry involving faults on AC electrical systems. The SOER contains recommendations for inspections of electrical busses. Byron Station committed to inspecting the non-segregated bus ducts. The inspections included insulators, fire barriers, wall penetrations, grounding systems, drains, and bolted connections. The station did not include inspection of the caulking on the channel steel.

Additional preventative maintenance activities will be done as a result of this event.

A search on ETS of previous Byron events over the last five years found no events involving water intrusion into non-segregated bus ducts. The keywords used were "bus and duct." However, during a bus inspection prior to 1984 (before fuel load), following a trip of a Unit 2 SAT on the high voltage side. Water leakage was found and an attempt to caulk the channel steel to duct interface was done. The significance of the caulked joint was stressed with workers, prior to re-application for this event.

G. COMPONENT FAILURE DATA:

MANUFACTURER NOMENCLATURE MODEL NUMBER MFG PART NUMBER

H.K. Porter Insulator A-30 617A

IST Excore Detector N//A WL-23706

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Commonwealth Edison Company

Byron Generating Station

4450 North German Church Road

Byron, IL 61010-9794

Tel 815-234-5441

ComEd

June 21, 1996

LTR: BYRON 96-0179

FILE: 3.03.0800 (1.10.0101)

U.S. Nuclear Regulatory Commission

Document Control Desk

Washington, D.C. 20555

Dear Sir:

The Enclosed Licensee Event Report from Byron Generating Station is being transmitted to you in accordance with the requirements of 10CFR50.73(a)(2)(iv).

This report is number 96-007; Docket No. 50-454.

Sincerely,

K. L. Kofron

Station Manager

Byron Nuclear Power Station

KLK/WD/js

Enclosure: Licensee Event Report No. 96-007

cc: H. J. Miller, NRC Region III Administrator

NRC Senior Resident Inspector

INPO Record Center

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